Professor Nicole Zacharia

Assistant Professor
Department of Polymer Engineering
University of Akron

Modulating Interactions in Polyelectrolyte Multilayers

April 15, 2015
3:25 p.m.
202 Gavett Hall

Polyelectrolyte multilayers are versatile thin films and coatings made from the direction of polyelectrolyte complexation, where charged macromolecules are assembled via electrostatic or other types of secondary interactions. These materials have been proposed for use in a wide range of applications, from drug delivery to materials for energy storage to optical coatings or coatings with special types of wettability. One type of secondary interaction that has been less examined within these assemblies is the metal-ligand coordination bond. The first part of the talk will investigate how incorporating varying metal ions can change the physical properties such as modulus or adhesion. Using different multi-valent ions as well as alkali versus transition metal ions can control these changes in properties. In addition to using different types of bonds to make up the polyelectrolyte assemblies, the dynamic nature of the secondary interactions that do hold them together makes it possible for these materials to be responsive to external stimuli. These external stimuli work by changing the strength of these secondary interactions. It is well known that changes in pH or ionic strength in the surrounding environment can create changes in polyelectrolyte multilayer properties, generally by weakening the secondary interactions. Our group, however, has recently been examining the use of organic solvent to change the properties of polyelectrolyte multilayers. Organic solvents dehydrate the multilayers, contracting and densifying the film, as well as stiffening the film. This stimulus then can be used as the basis of creating actuating materials from polyelectrolyte multilayers.